

# FIRE II Cirrus

## Mission Summary



**Date: December 6, 1991**  
**Julian Day: 340**  
**Experiment Day: 24**

[Summary](#) | [Active Sensors](#) | [Passive Sensors](#) | [Sonde and Sfcmet](#)

Mission Scientist: David Starr  
 Deputy Mission Scientist: none

### Mission Objective:

Regional development and dissipation of cirrus systems and observation of cloud microphysical, radiative and dynamical properties.

### Mission Description:

Day #1 of Third Intensive Observing Period.

The large-scale enhanced temporal resolution sounding network was activated. The Sabreliner and King Air flew *in situ* cirrus missions over the Hub in close coordination with ground-based observing systems during the morning. The King Air mission focused on penetrations of cirrus generating cells at cloud top while the Sabreliner concentrated on extinction measurements. The King Air reported one of its best microphysical missions. The King Air also observed a thin but uniform altocumulus cloud layer over Parsons in the afternoon including samples of its own contrail in this supercooled cloud. The Sabreliner worked the same cloud layer in its second mission again collecting excellent measurements.

[A planned objective of a coordinated ER-2 underflight of NOAA/AVHRR over the Hub was scrubbed by high winds at Houston which was just as well since the cirrus at Coffeyville cleared by afternoon.]

### Weather Synopsis:

Morning temperatures were above freezing for the first time in a week. Some ground fog in low lying areas. Cirrus clouds moved over the region in the early morning at altitudes from 7-9 km. Visually, there appeared to be two basic cirrus layers with a cellular cirrostratus above and cirrus spissatus at lower levels. Some low level stratus came over the area from the south during the morning but by noon the clouds had pretty much disappeared, including the cirrus. Midday temperatures reached 50deg.F with with strong southerly winds. Parsons reported an altocumulus deck covering most of the sky at 7km in the early afternoon.

### Synoptic Situation:

Synoptic conditions in the Southwest and Southern Plains continued to be influenced by the upper level low that drifted onshore over the Baja Peninsula and into northwest Mexico. A wrap-around dry feature had moved steadily through Oklahoma during the previous night (Dec 5-6). Water vapor imagery showed a distinct dry band feature through Colorado and north Kansas which separated the southern and northern upper level air masses. Cirrus were evident in central and eastern Texas and northward into eastern Kansas. An extensive baroclinic zone cirrus system had formed in association with the large-scale ridge on the West Coast. This ridge was presently of relatively low amplitude but showed signs of movement and steepening in response to an approaching trough in the eastern Pacific Ocean.

Aircraft	Depart	Land	Notes
NASA ER-2			No flights, high wind restrictions at base.
NCAR King Air	08:07 CST	11:03 CST	Excellent flight in cirrostratus with multiple generating cell penetrations over Hub
NCAR Sabreliner	08:49 CST	11:18 CST	Good radiative obs of cirrus over Hub
NCAR King Air	13:01 CST	14:38 CST	Coordinated with lidar at Parsons - altocu.
NCAR Sabreliner	13:16 CST	15:02 CST	Good radiative obs of thin altocu.
UND Citation			No flights

Satellite	Hub Overpass Time	Zenith Angle	Azimuth Angle	RAOB
NOAA-11	20:56:47	0.58	291.30	yes
	09:21:11	43.31	100.30	yes
NOAA-12	14:55:47	45.85	288.79	yes
	02:15:48	57.45	262.94	yes

[^ Top of Page](#)

### Rawinsonde Operations:

- Inner NWS stations (Type A): Intensive mode @ 12, 18, 00, 06 and 09 UTC
- Outer NWS stations (Type B): Intensive mode @ 12, 18, 00 and 06 UTC
- Hub CLASS station: Intensive mode @ 12, 18, 00, 06 and 09 UTC,
  - plus satellite overpasses @ 15, 21 and 02 UTC
- Remote CLASS stations: Intensive mode @ 12, 18, 00, 06 and 09 UTC
- Hub GSFC/WFF station: Launches @ 20, 22, 00, 02, 05 UTC
- CSU Parsons station: Launch @ 17 UTC

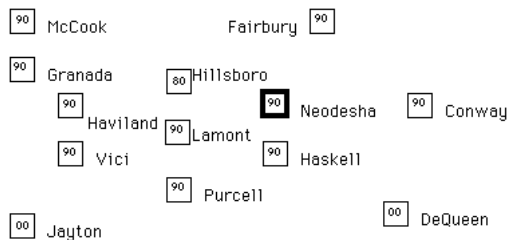
### FIRE Profiler Status:

- CSU 405 MHz @ Parsons: Continuous operation (no RASS)



- PSU 50 MHz @ Coffeyville: Continuous operation with RASS
- NOAA 405 MHz @ Coffeyville: Not operational

#### WS Wind Profiler Status:



#### SPECTRE Operations:

Afternoon and evening operations under fairly clear conditions.

#### Aircrew/Mission Scientist Debrief Notes:

- **GENERAL:** Most of the lidar systems took good observations on this morning. Cirrus were observed from 7-9 km at 06:30 CST. Cloud top seemed to descend during the morning. By 10:30, the VIL images showed an apparent generating layer at 7.2 km that was only about 200 m deep with a spissatus-like fall streak mass extending down to 5 km. However, the CO2 lidar and PSU radar still showed tops at ~8.5 km at that time.
- **NCAR SABRELINER #1:** Climbed to cloud top at 31K' over the Hub and flew a cloud top racetrack from Hub to WSW at cloud top. Cloud base was reported at 18K'. Cloud was very uniform in appearance but with some embedded generating cells. Cloud albedo was estimated at 40. Noted that cloud top seemed to be subsiding and was wispy with very small particles. A second racetrack was flown at 27.5K' skimming cloud top at that time. Cloud began to thin noticeably on third racetrack at 25K'. Low level clouds were approaching. Climbed to cloud top at 31K' and spiraled through the cloud as descended to land. A good solar reflectance case.
- **NCAR KING AIR #1:** Made spiral sounding to 8.9 km over Hub. Cloud base at 5.7 km (19.1K', -15deg.C) and top at 8.9 km (-39deg.C) where a relative humidity of 100 was found. Large aggregate-appearing particles were sampled and a colored halo was observed on climb. Generating cells protruded to 9.3 km (-42deg.C) and a sun dog was observed at cloud top. Cloud top wasn't very flat with the cells and wisps. Four generating cells were penetrated with 10 km of the Hub. Some supercooled drops and some frozen drops were observed. Did spiral descent to 19K' over Hub. Cloud was one deck but not real homogeneous (contrast this to Sabreliner description). Bullet rosettes larger than 1 mm were observed in the lowest kilometer of the cloud. Particle concentrations (2D-C) ranged from 100 per liter in generating cells to 15-20 per liter in the lower portion of the cloud. Flew upwind/downwind legs at 19, 20, 21, 22, 23, 24 and 28K'. The cloud was separating into two distinct layers: an altocumulus cloud at 24K' and a cirrus generating layer at 29K' with fall streaks. Continued to work generating cells at 28K' (500 m below tops). Things then began to dissipate rapidly and a spiral sounding was flown to landing.
- **NCAR SABRELINER #2:** Took radiative measurements over, under and within a 20 m deep altocumulus cloud - "You could see the blue sky and the ground when we were in the cloud. It was like being at cloud top and cloud base at the same time." Very good data!!
- **NCAR KING AIR #2:** Did sounding to 29K' over the Hub. A midlevel cloud deck was found between 600 and 640 mb with absolutely clear above. Went to Parsons and worked this cloud layer in coordination with LaRC lidar. Particle concentrations were 40 per cc by FSPP with a narrow size distribution. Sampled own contrail where particles up to 100 um were observed. Glaciation was observed here and there in this cloud deck. Sampled particles up to 500 um and particle concentrations up to 100 per liter in the fall streaks. Took slides in clear air, supercooled cloud drops, contrail and fall streak portions of the cloud.

#### Significant Hardware Problems:

- King Air 2D-P probe inoperative on 1st flight.
- Sabreliner cryogenic hygrometer inoperative on 2nd flight.

#### Highlights of FIRE Operations:

- Excellent microphysical observations of cirrus generating cells.
- A good Hub cirrus day with close coordination between aircraft and surface systems.
- Very good observations of a thin altocumulus cloud by aircraft and lidar (LaRC).

[^ Top of Page](#)

## Instrument Logs

### Active Sensors

Active Sensor	UTC Hour																								Notes
	12	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05	06	07	08	09	10	11	
Utah Lidar H																									NO OBSERVATIONS
LaRC Laser Ceilometer H	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Wisc HSR Lidar H				X	X	X	X	X	X																
Wisc Vol Image Lidar				X	X	X	X	X	X																
GSFC RAMAN Lidar H													X	X	X	X	X	X	X						
NOAA CO2 Lidar H	X	X	X	X	X	X	X	X	X																
NOAA Radar H																									NOT OPERATIONAL
PSU Radar H	X	X	X	X	X	X	X	X	X	X	X														
PSU Laser Ceilometer H	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
PSU 50 MHz Wind Prof H	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	

PSU/NOAA 50 MHz RASS H	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
NOAA 405 MHz RASS H																							NOT OPERATIONAL
LaRC Lidar P	X	X	X	X		X	X	X															
CSU Wind Prof/RASS P	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	NO RASS
CSU Laser Ceilometer P	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	

[^ Top of Page](#)

#### Passive Sensors

Passive Sensor	UTC Hour																								Notes
	12	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05	06	07	08	09	10	11	
NOAA $\mu$ -wave Radiometer H																									
NOAA Sun Photometer H																									
NOAA H20 Photometer																									
NOAA IR Flux Radiom. H																									
NOAA Dobson Ozone H																									
NOAA Surface Ozone H																									
NOAA Trace Gas H																									
PSU $\mu$ -wave Radiometer H	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
PSU Sun Photometer H				X	X	X	X																		
PSU Solar Flux Radiom. H	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
PSU IR Flux Radiometers H	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
PSU Sky Video H																									NO OBSERVATIONS
Utah IR-Window Radiom. H																									NO OBSERVATIONS
Utah Sky Video H																									NO OBSERVATIONS
LaRC Video H	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
AFGL Sky Imager H																									NOT OPERATIONAL
Ames Radiometer H																									NOT OPERATIONAL
Denver Solar Radiom. H							X			X															
Denver IR-Spectrometers H							X	X	X	X	X			X	X	X	X	X							
GSFC IR-Spectrometer H							X	X	X	X	X				X	X	X								
Wisc. IR-Spectrometer H			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X								HOURS 21 TO 00 UTC CALIBRATION
MRI Sun Photometer H																									NOT OPERATIONAL
MRI IR Radiometer H																									NOT OPERATIONAL
MRI Spectro-Radiom. H																									NOT OPERATIONAL
MRI Solar Flux Radiom. H																									NOT OPERATIONAL
GSFC Sun Photometer H																									NOT OPERATIONAL
CSU Sun Photometer P			X	X	X	X	X	X	X	X	X														
CSU IR-Window Radiom. P	X	X	X	X	X	X	X	X	X	X															
CSU Solar Flux Radiom. P			X	X	X	X	X	X	X	X	X														
CSU IR Flux Radiometers P			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
CSU IR-Spectrometer P							X																		
CSU Sky Video P			X	X	X	X	X	X	X	X															
Ames Spectroradiometer H																									NOT OPERATIONAL
Ames 10 $\mu$ m narrow fov H																									NOT OPERATIONAL
CISRO/WPL/PSU IR W. Rad	X	X	X	X	X	X	X	X	X	X	X														

[^ Top of Page](#)

#### Sonde and Surface Meteorology

Sonde + Sfc Met Sensor	UTC Hour																								Notes
	12	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05	06	07	08	09	10	11	
NOAA Ozone Sonde H																									
WFF Sonde H							X			X	X			X			X								
NCAR Cloud Ice Sonde H			X																						
NCAR/CLASS Sonde H	X		X			X			X			X	X								X				06 UTC MISSING. SOME WIND DATA LOST
NCAR PAMS H	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
NCAR/CLASS (remote)	X					X						X						X			X				IOLA MISSING @ 12 UTC, SOME WIND DATA LOSS
NCAR PAMS (remote)	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	ARKANSAS CITY CAME UP AT 16 UTC, AND IOLA AT 21 UTC
CSU Sonde P					X																				
CSU Sfc Meteor. P			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Type A NWS Sondes	X					X							X					X			X				

